A Baetech Publication

March 1988

4/5/88 C0750-1

COMPUTER DECISIONS

AIR WARS!

SYSTEM VS. SYSTEM IN THE FIGHT TO FILL SEATS

********** 5-DIGIT 20814
CD0140103-3
K JAMES EDP VP
CIS
EDP
4520 EAST WEST HWY
BETHESDA MD 20814

MICRO MANAGERS SAY: 'WE WON'T DUMP DOS'

BEST METHODS FOR EVALUATING CASE TOOLS

OUR MICRO VENDOR REPORT CARD

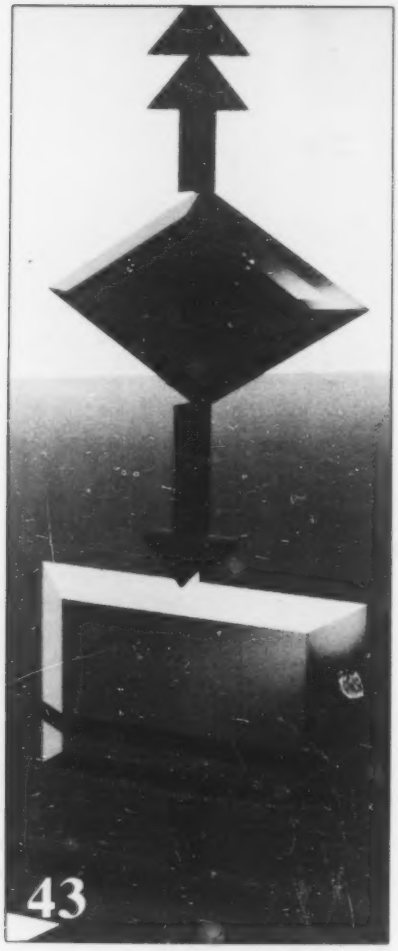
COMPUTER
DECISIONS
Vol. 20 No. 3 March 1988

COVER STORY

MIS PILOTS THE AIR WARS 36
MIS heads up a billion-dollar, white-hot competition among the airlines for travel agency desktops. The second entry in our 'MIS in Transition' series.
by Byron Belitsos

Innovation Architect 41
To Mark Teflian, who at United Airlines subsidiary Covia Corp. led the development of the first distributed computerized reservation system, success means keeping one step ahead of IBM.

FEATURES



EVALUATING TOOLS: CASE STUDIES 42
Two members of a data administration team at insurance giant Travelers Corp. outline a winning strategy for selecting computer-aided software engineering tools.
by Linda Nadeau and Jeff Rodgers

PERFORMANCE REPORT: SAFETY IN NUMBERS 45
Contrary to the predictions of some pundits, the microcomputer industry continues to grow at a booming rate. The numbers tell the tale.
by Patrick Flanagan

ROUNDTABLE: DUMP DOS? NO WAY, NOT YET 50
The future may belong to Operating System/2, but DOS isn't dead yet. Our panel of experts looks at the next five years of micro applications.

OF NEW SHOWS AND NO SHOWS 49
Who needs another trade show? Cahners Exposition Group (with Connect/88) and Interface Group Inc. (with World Computer Conference) hope MIS does.
by Miriam Lacob

Computer DECISIONS (USPS 771-1040 ISSN 0010-4558) is published monthly for $65 per year by BAETECH Publishing Corp., Glenpointe Centre East, DeGraw Ave., Teaneck, NJ 07666. Second-class postage paid at Teaneck, NJ 07666 and additional mailing offices. POSTMASTER: Send address cha..ge to *Computer* DECISIONS, P.O. Box 1031, Southeastern, PA 19398. For subscription information, please call (215) 630-9323.

FRONTMATTER

DECISIONS Intelligence 13

PERSPECTIVES

IBM World 15
Behind IBM's 'openness'

Database Decisions 16
Expert DBMSs aren't hype

Information Interface 17
Avoid network overkill

Information Strategies 18
Software: A call to action

Corporate Micros 19
DEC adds the MAC factor

TECHNOLOGY TRENDS

Manufacturing 20D
Improved data exchanges

Software 21
'Roll ups' are on a roll

Networks & Communications .. 25
Connectivity by design

Microsystems 28
New ways to extend DOS

Connectivity 31
IBM shows LAN clout

Systems & Peripherals 34
A lesson in a tremor

SOLUTIONS FILE

Five networks, no problems ... 20
Key Corp. manages five networks and reduces its communications costs at the same time.

A relational DBMS vision ...20C
Allergan Inc. improves its manufacturing controls with a relational database manager.

PRODUCTS

Buyers' Guide 55
Micro Channel enhancements

Product Spotlight 58
IBM's Enterprise Systems Architecture: Born-again mainframes

New Products 60

Advertiser Index 60

EDITOR'S MESSAGE

Technology Vs. Results

There is a split personality in this information systems game, and we all wake up every morning with it. One side says, "Get it done"; the other, "Get it done right." More often than not, the angels appear to stand with the latter.

In this issue, however, we take a look at a giant industry segment, the airlines, in which the results-oriented side has just about wiped out both the practical and aesthetic imperatives for standardization per se. The reason is simple: competition.

As Senior Editor Byron Belitsos points out, the world's largest nonmilitary database and (most likely) largest private network are products of this runaway complex. It has also produced a "war room" in which one airline alone can process 1.5 million fare changes *on a single day*. People clobbering transactions into a Xenix-based system in this kind of atmosphere aren't much concerned about when, say, a Unix standard becomes reality.

Interestingly, the airlines' rule-bending innovations in information systems bring them a higher return on investment than does the actual flying of airplanes. But in that end of the business, S.O.P. is the rule. I'm extremely happy that it is. On the same day recently, coming in and out of Austin, TX, I sat through both a missed landing approach (fog) and later an aborted takeoff (apparently nothing more than a popped circuit breaker on a warning horn). On days like that, you can only be grateful that there is a book and people professional enough to go by it.

Obviously there will be times when airline MIS managers will need to reconcile their systems to certain standards, just as there will be times when pilots have to be creative. If that weren't so, there wouldn't be much art to any enterprise. Uncle Dougal was an Army Air Corps instructor in B-25s. Once, at an airbase in west Texas, he had a suspected engine fire and declared the emergency, in strict and proper aviation syntax, while requesting a landing clearance. The tower operator, apparently half asleep, asked him to start over and repeat everything.

"One churning, one burning," Uncle Dougal barked back. "I'm coming on in."

Robin Nelson

Cover Illustration:
Cheryl Griesbach/
Stanley Martucci

TECHNOLOGY TRENDS/Connectivity

IBM SHOWS LAN CLOUT

Byron Belitsos

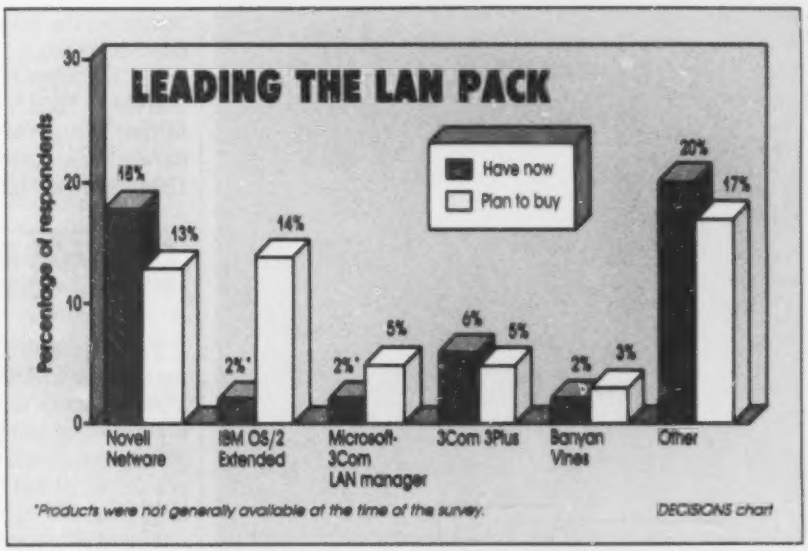
To those who doubt IBM's mainframe marketing touch can be extended to the world of microsystems, consider the following. More respondents to the fourth DECISIONS/Paine Webber Survey of MIS Attitudes said they plan to buy an untested, unavailable LAN operating system from IBM than said they plan to buy Novell Inc.'s Netware.

The operating system, of course, is IBM's Operating System/2 Extended Edition, which, IBM says, will contain a "LAN Server" that makes it effectively a local-area network operating system. OS/2's appeal to the reader base used in the surveys—MIS managers in large corporations—has always been strong. This is IBM marketing muscle at its best: MIS has already begun lining up for a new product even though it has only been vaguely described and can't be tested by users.

The survey question that yielded this result asked, "Which of the following do you use now and/or plan to buy during the next 12 months *as your primary LAN operating system*?" The response pattern (see chart) has major implications for vendors scrambling to gain an edge in the OS/2 era. The survey data say IBM and Novell have the advantage, even over the highly publicized LAN Manager from Microsoft Corp. (Redmond, WA) and 3Com Corp. (Mountain View, CA).

Of all of IBM's competitors, Novell (Provo, UT) appears to be sitting pretty with the largest installed base of any vendor (18 percent) among respondents, and what is apparently a loyal following. Thirteen percent of respondents plan to install Netware during the next year.

By comparison, 3Com's 3Plus commanded only a 6 percent share of installations among respondents. Five percent plan to install 3Plus during



Vincent J. Gallo

OS/2 Extended Edition has won over many MIS managers even before its release, according to the latest DECISIONS/Paine Webber survey.

next year. As for the LAN Manager, only 5 percent of respondents indicate they'd bite during the next year.

As might be expected, OS/2 Extended is more popular with respondents in IBM mainframe sites, and less popular in Digital Equipment Corp. VAX shops. The only anomaly in these data are the respondents who said they've got OS/2 Extended or LAN Manager installed. Neither was available when the survey was conducted last November. These figures can only be interpreted as reflecting erroneous, albeit overly enthusiastic, responses.

There's some irony in the fact that IBM and Novell appear to be poised to compete for OS/2 LAN operating software business. Novell officials have repeatedly declared their policy is to sail close to OS/2 Extended, as opposed to Microsoft's brand of OS/2 and LAN Manager. "We've got a very good relationship with IBM," says Darrell Miller, vice president of marketing at Novell.

Given Microsoft's cooperation on LAN Manager development with Novell's archrival 3Com, the policy is not surprising. Yet the survey results suggest that Novell will compete with IBM in LAN operating systems, not with Microsoft/3Com.

Technical realities also say Novell must compete with IBM. Vendors like 3Com and Corvus Systems (San Jose, CA) will be able to run their LAN operating systems as tasks under OS/2, allowing their packages to coexist with OS/2. Novell doesn't have that option. Netware is a protected-mode operating system, and, as such, can't run under OS/2, but only in competition with it.

Novell's strategy to ensure a place for Netware in the new OS/2 order is simple: Netware and OS/2 should run side by side, says Miller, one on a network server and the other on a file/database server. This distributed design will yield better network perfor-

NOW THERE'S A NEW NAME ON THE BLOCK FROM THE LEADER IN DATA TRANSFER SOFTWARE...

The Systems Center put the foundation in place with Network DataMover (NDM) for MVS. It became the data transfer standard among leading corporations with multiple MVS mainframes. To top it off, now there's Network DataMover for VM.

The two products are built on a common architecture. Which gives you the ability to transfer VM files, such as CMS, into one of many MVS file formats. And vice versa. NDM also gives you complete control over MVS and VM data transfer operations through automation, security and detailed audit trails.

So whether your network includes MVS, VM or both, NDM offers a single solution. But these are just two of the NDM names on the block. There are more just around the corner...

1-800-292-0104
In Texas 214-550-0318
The Systems Center, Inc.
2477 Gateway Drive, Suite 101
Irving, TX 75063

The Network DataMover Company

CIRCLE 15

TECHNOLOGY TRENDS

mance than configurations that put the network database and operating system in a shared server, he says.

Alternatively, Novell advocates running Netware on a coprocessor in the same server with OS/2. IBM's Micro Channel bus would facilitate this arrangement.

Both of Novell's recommendations find room for Netware beside OS/2. And Novell has taken one additional step to ensure it can play with IBM software: It announced that IBM's Logical Unit 6.2 peer-to-peer protocol will be its connectivity method. Miller believes LU 6.2 is IBM's direction with its LAN Server, and Novell intends to be compatible with that product, he says. Microsoft and 3Com, on the other hand, are advancing a competing connectivity scheme called named pipes.

LU 6.2 support will give Netware close connectivity to Netview, IBM's network management system, notes Miller. Status and alert information from Netware's own network management functions can be integrated into IBM's central Netview system. *—John Rymer*

FIVE-YEAR STUDY OFFERS NEW INSIGHT INTO NETWORK COSTS

Findings based on a five-year study of 17 IBM and DEC networking sites at 14 large corporations may help MIS get a better handle on rising network costs. The study, probably the most comprehensive of its kind, yields some surprising conclusions that may change the way MIS managers think about the expenses involved in designing, installing, and operating computer networks.

For most network managers, the way to control rising network costs is by installing new technical solutions: T-1 multiplexers, data compression, network management software, fast packet switches, and the like. So-called soft costs—personnel and organizational expenses—aren't often factored in, especially when new equipment selection is on the agenda.

When soft costs are ignored, it is at the expense of accuracy. Even sincere attempts to gauge soft costs may be stymied for lack of a rigorous, time-tested methodology with which to measure them. The result is reliance on the imperfect method of measuring the network's impact on corporate performance.

Chief among the findings of the study, which was funded by DEC, is that it can cost twice as much or more to operate a computer network than it does to install it. At the companies studied, equipment and software acquisition costs comprised about a third of total network costs during the study period; personnel expenses also accounted for nearly a third of total costs. At many sites, personnel costs (for operating and maintaining the network) were the single highest expense over the five-year span. For example, personnel and associated costs accounted for 50.5 percent of all networking expenses for the manufacturing networks studied and 29 percent of overall costs in a corporate network.

The researchers were also surprised to discover that communications costs, often a major consideration of network managers in designing and operating networks, may be of far less relative importance in the total cost picture.

COMPUTER
DECISIONS
COVER STORY

MIS PILOTS THE AIR WARS

Major airlines are putting MIS at the fore of a white-hot competition with billion-dollar stakes. The second entry in our 'MIS in transition' series.

by Byron Belitsos

The airline industry, more than any other business sector, illustrates the increasing importance of information systems in gaining a competitive edge. Air transportation today is a commodity service. The window on flight information provided by the travel agency workstation is now the strategic factor in competition among the airlines.

The airline that captures the travel agency desktop controls both the agent's and the passenger's gateway to information about its services and those of its competitors. That control is crucial: Of the nearly 40,000 travel agencies in the United States, 90 percent are automated. The airline that provides an agency's computerized reservation system (CRS) is up to 30 percent more likely to gain bookings on its flights, studies show.

MIS holds the keys to both capturing and maintaining that customer relationship, first by locking the travel agent into its CRS network, then by offering improvements in the travel agent's user interface and integrating office automation applications on the same workstation. MIS must also provide a network architecture underpinning increasingly advanced applications to improve the travel agent's productivity. With the widespread introduction of the IBM Personal System/2 and Token-Ring local-area network into reservation systems, as well as United Airlines' recent unveiling of a distributed CRS architecture, competition in the air wars promises to be hotter than ever.

The race to build proprietary CRSs began in 1975, after representatives from the major airlines and travel agencies met to consider establishing an industrywide computerized reservation system. A few months after that meeting, United Airlines and American Airlines pulled out of the industry organization just a day apart. The race was on to offer travel agents proprietary systems.

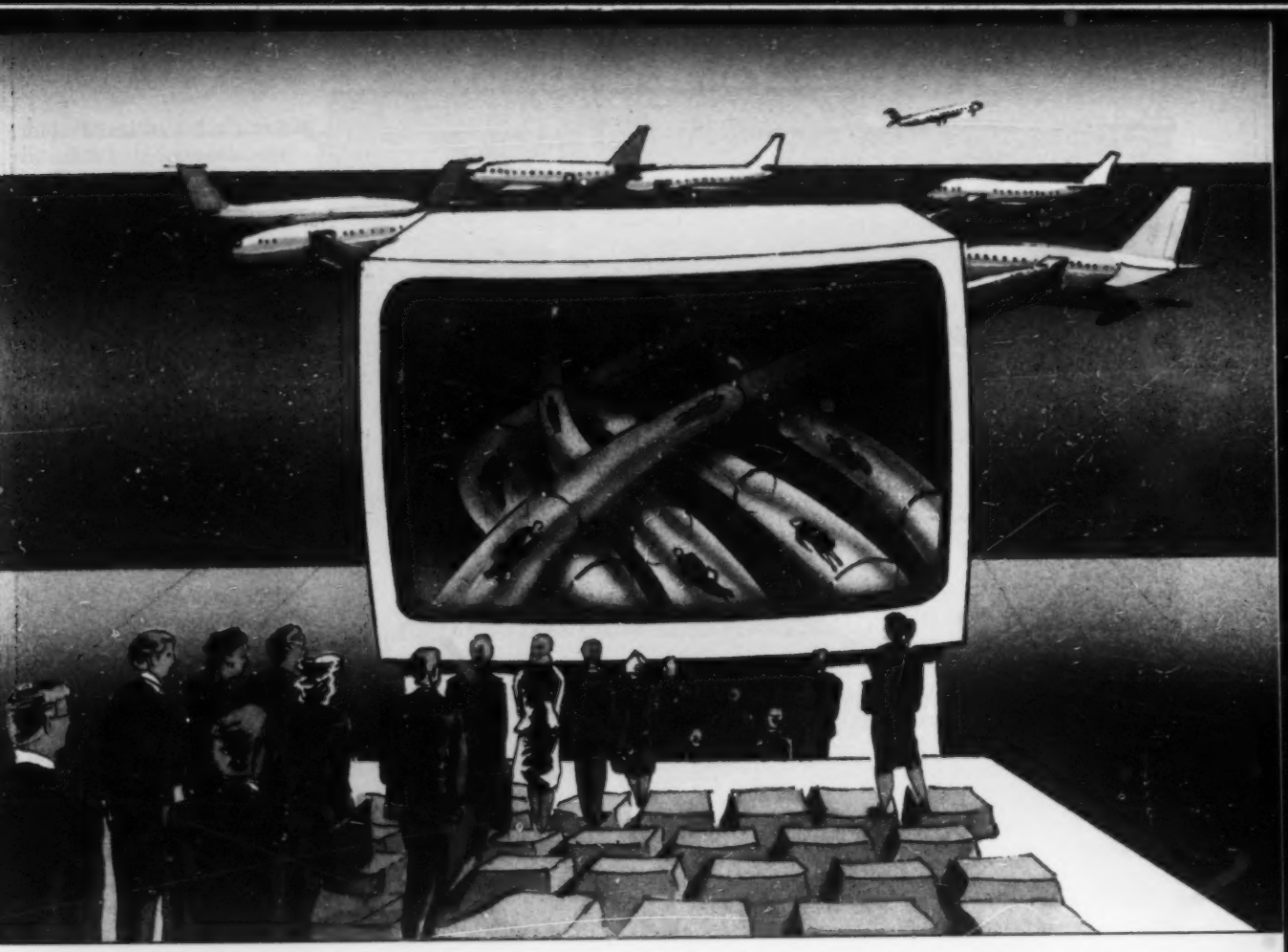
AMERICAN AIRLINES

AA The origination of proprietary computerized reservation systems can perhaps be traced to a conversation in 1975 between Max Hopper (left), senior vice president of MIS, with Robert Crandall, then finance vice president and now chairman of AMR Corp., American's parent. Their discussion followed a meeting of the major players to consider a joint CRS. "This is the coming distribution system," Hopper recalls saying. "Giving it to someone else is not in our best interest."

MIS then came to the fore. At the time, only a minority of the nation's 12,000 travel agencies then in existence were expected to request direct links to CRSs, then used only internally by the airlines. United Airlines made the first move, introducing its Apollo system in a few select agencies. However, Max Hopper, then a data processing manager and now senior vice president of MIS at American Airlines, led an aggressive development and marketing effort for the airline's SABRE (Semi-Automatic Business-Related Environment) system.

SABRE quickly captured 90 of the top 100 travel agencies, leaving Apollo far behind. Although TWA introduced its Programmed Airline Reservation System (PARS) soon after the leaders, late in 1976, it trailed a distant third. American had won the crucial early battle of the reservation wars.

Other battles followed. In 1978 deregulation set off an information explosion, and the airlines scrambled to gear up their reservation systems to cope. Previously, alternative fares and flying schedules had been few, and fares changed only a few times a year. "Deregulation, especially with discount fares and the proliferation of new carriers and added routes, caused fares to change at



Andrea Baldeck

phenomenal rates," says Bill Jewell, director of communications engineering at American Airlines.

Today, American has a group of more than 70 pricing analysts, programmers, and operations researchers dedicated to setting the fares most likely to give it an edge in the reservation wars. The group performs what it calls yield management, calculating a flight's optimal revenue yield per seat. Those calculations are done with Dinamo, a sophisticated in-house program that runs on an IBM 3000 series processor.

Among the most important factors in Dinamo's calculations are the fares offered by other airlines on that same flight segment. "Since competitors are constantly changing fares to gain a competitive edge as the actual flight time approaches, our fares for the same segment must fluctuate accordingly," explains Joe Selman, an American spokesman. "During routine times, we have to load 200,000 new fares a day. In a fare war, this figure approaches 1.5 million."

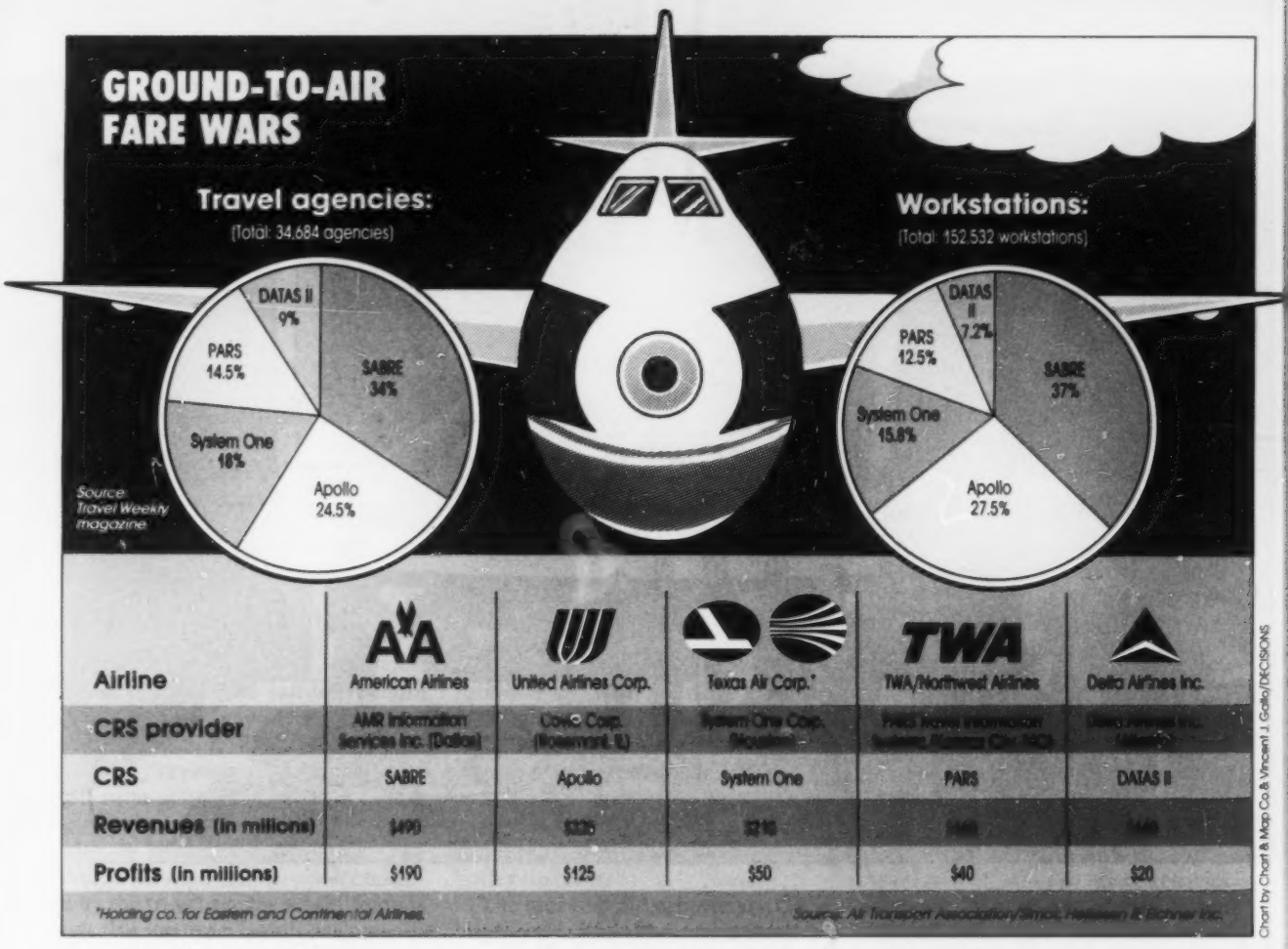
As a result of deregulation, any one transaction with a CRS's centralized databases became far more complex. "To process a typical transaction in a system with a two-second standard response time used to consume about 5,000 [computer] instructions," says Mark Teflian, vice president of technical planning and systems engineering at Covia Corp., United Airlines' information processing subsidiary, established in 1986. "Now, each transaction uses up to a million instructions. At peak times, because of the exploding number of agency CRTs on the network, we handle over 1,400 transactions per second."

Delta Airlines entered the reservation wars last, in 1982, with its DATAS II system. DATAS II was upgraded in early 1987 with the introduction of the Deltastar system. Texas Air also became a major player when it acquired Eastern Airlines in 1986. By buying Eastern, Texas Air gained control of Eastern's System One CRS, introduced in 1981.

Last year's introduction by United of its distributed architecture upgrade to Apollo confirmed a major trend: Computerized reservation systems are the core marketing strategy of the five major airlines. "All the big airlines except TWA introduced new versions of their reservation systems last year," says Nadine Godwin, automation editor of *Travel Weekly*, the leading airline industry trade journal. "It was the biggest new product year ever for both hardware and software."

Little wonder. Per dollar spent, the airlines now make more money on their reservation systems than they do flying passengers. According to Edward Stackman, an airlines analyst at Wall Street brokerage Paine Webber Inc., in a good quarter the airlines have an 8 percent to 10 percent profit margin overall, while CRSs make as much as 20 percent profit. In 1984, SABRE netted American a 40 percent profit. "The last thing you want to do with an airline is fly airplanes," quips Peter Keen, an information technology strategy consultant and president of the International Center for Information Technologies (Washington).

The current stage of the reservation wars involves the introduction of personal computers into travel agencies. All the airlines—with the exception of TWA—are now trying to convince



The airlines' battle for travel agency territory is a crucial one. The CRS vendor who provides an agent's system is one-third more likely to gain bookings on its own flights, studies show.

agents to upgrade from dumb terminals to IBM Personal System/2s and Operating System/2, allowing data and applications to be offloaded from central mainframes.

"The PS/2 gives us the freedom to do a lot of things with the user interface that weren't possible before," says Terrell Jones, vice president of product development at AMR Information Services, American Airlines' information processing subsidiary. "When you run a host system with 60,000 terminals and two- or three-second response time, you can't offer easy-to-use, fill-in color screens."

Delta was first to announce a PS/2-based CRS, early last year. Delta has installed 1,200 Model 30 PS/2s in the last three months, and is expecting to continue installing them at that pace.

With PARS, TWA has offered microcomputer-like functionality to agencies since 1985, when it introduced the Office Management System (OMS), the industry's first integrated travel/business automation system. OMS set the standard for the PS/2-based applications the four rival carriers are now unveiling. OMS hardware includes dumb terminals in a multiuser configuration based on an Altos 1086 or 2086 processor running under the Xenix operating system.

According to Martha Valkind, vice president of product planning at PARS Travel Information Systems, TWA is now considering upgrading to Intel 80386-based micros, Xenix V.3, and color terminals. She's not convinced that the other carriers will gain an edge with PS/2-based systems. "Of course, we are going to look at OS/2," she says. "But to date we don't think the IBM product line is really out there."

Delta, United, and American plan to link travel agency PS/2s via IBM Token-Ring LANs to integrate back-room travel agency management applications with reservations processing, much like PARS's OMS. The PS/2s on the agency LANs American and United will be offering are diskless systems—American will offer Models 30 and 50, United the Model 50 only—tied to a Model 60 acting as a local file server. An additional Model 50 will act as a dedicated intelligent gateway for communications with mainframes.

For booking reservations, all the CRSs offer an improved user interface with some variation of a multicolored, menu-driven screen that simplifies fare calls to central mainframes. Fill-in screens will streamline the training of new agents. Previously, new agents had to learn hundreds of complex encrypted codes based on an industry-standard reservation message format to build each Passenger Name Record, the basic data that comprise an airline booking. With the upgraded systems, English-language entries or macro programs can be used instead.

The more sophisticated new applications the carriers are offering in-

clude the ability to build individual or corporate customer profiles that can be automatically merged with the Passenger Name Record whenever new bookings are made. Similar packages aimed at large corporate travel departments direct agents to select the fares, airlines, hotels, and other travel and entertainment elements that match corporate travel policy parameters. American's new Capture package, for instance, not only enforces corporate travel policies but also simplifies the travel and entertainment expense reporting process by capturing all travel spending information and building a consolidated expense report.

As of January, American had placed PS/2s in over 300 travel agency locations. "We're using PS/2s not only to expand our user interface into the mainframe database, but also to capitalize on all the software available for the PS/2 platform," explains Jones. For example, American just introduced SABRE Works, an adaptation of Microsoft Corp.'s Microsoft Works for use in travel agencies. Like the OMS package developed for PARS, SABRE Works allows agents to use the same machine to move between reservations functions and word processing, spreadsheet, and database applications.

The rules of the reservation wars are changing again with Covia's upgrade to the Apollo CRS. The new version of Apollo is the industry's first fully distributed transaction processing system.

Barry Kotar, president of Covia, calls the new distributed system a "third-generation" reservation system. The first-generation network architecture was based on a single, unshareable mainframe database used internally by the airlines, Kotar explains. The second generation included multiple mainframes and a shared database, using IBM's TPF (Transaction Processing Facility) operating system.

Based on the new distributed architecture, Covia's new Focalpoint product line for agencies offers the most advanced functionality of any of the new CRS offerings. Focalpoint, which took two and a half years to develop, allows sophisticated PS/2-to-host communications and intelligent cooperative processing via IBM's Logical Unit 6.2 protocol. Apollo's new Open Systems Manager communications software, developed to support fully distributed applications and database distribution across the network, allows location-independent processing. Subsets of OSM may reside in computers at all three levels of the architecture hierarchy: in TPF-based hosts or other hosts, in regional processors, such as airport systems, or in desktop workstations. Focalpoint also includes a graphics-oriented, multitasking user shell based on Microsoft's Windows.

United plans to exploit Microsoft's OS/2 and any extensions IBM adds to it. According to Rick Pemberton, senior technical support design analyst at Covia, one of United's first applications of OS/2 will be to use its multitasking capability to combine file server and gateway functions on one PS/2.

The travel agent's interface is radically changed by the combination of Focalpoint's Scriptwriter feature and Microsoft Windows. Using Windows, up to four online network transactions can be displayed on the same screen. Scriptwriter also guides agents by providing simple prompts that require English-language entries. The new format will save agents up to three-quarters the normal number of keystrokes on Apollo.

Scriptwriter makes windowing simple, says Pemberton. With one request, an agent can automatically display fare quotes from up to four airlines, or bring up windows concurrently to show such information as a flight's seat availability, a personal or corporate profile, and the fare quote. In the past, such information was handled by agents in separate steps and in successive screen displays.

United turned to the new architecture because of the harsh lessons the company learned playing catch-up to American's SABRE. As travel agency demands for automation exploded in the 1970s, United sometimes had to postpone adding new terminals to its network while it upgraded its host facilities. "We had to physically replace all the hardware at the Apollo central site every two years," says Kotar. "We were always dependent on IBM or some other vendor to give us the next biggest piece of hardware or some advance in storage technology that would give us the needed capacity. We were continually up against a wall."

At that point, United's MIS organization began evaluating alternatives for a new architecture. Several years of planning led to a choice of a distributed architecture based on IBM's Systems Network Architecture/Synchronous Data Link Control (SNA/SDLC). "We adopted SNA for our back-

UNITED AIRLINES

Will Covia's new distributed version of its Apollo CRS give it the boost it needs to catch up to American's front-running SABRE system? Barry Kotar, president of Covia, thinks so. "SABRE can't support a distributed environment, and American doesn't have a plan for the equivalent of Open Systems Manager," he says. "It hasn't thought through the issue of developing software for distributed applications. We've spent two and a half years developing this environment."

TEXAS AIR

Texas Air, the holding company of Eastern Airlines and Continental Airlines, currently ranks as the largest carrier in the country. Texas Air may have entered the reservation wars late, but it's risen to the number-three slot with its System One CRS. Key to its success: its travel agency conversion tactics, which include defending defecting agencies in any lawsuits brought against them by their original CRS suppliers. System One is headed by Bill Murray (pictured).

For airlines in the reservation wars, spending hundreds of millions on systems is not enough.

bone architecture even though back in 1981 the limitations of SNA were significantly greater than they are today," says Kotar. "We decided to take advantage of existing products and concepts where possible, including IBM's Personal Computers and token-ring networking, plus products from other vendors, such as Microsoft."

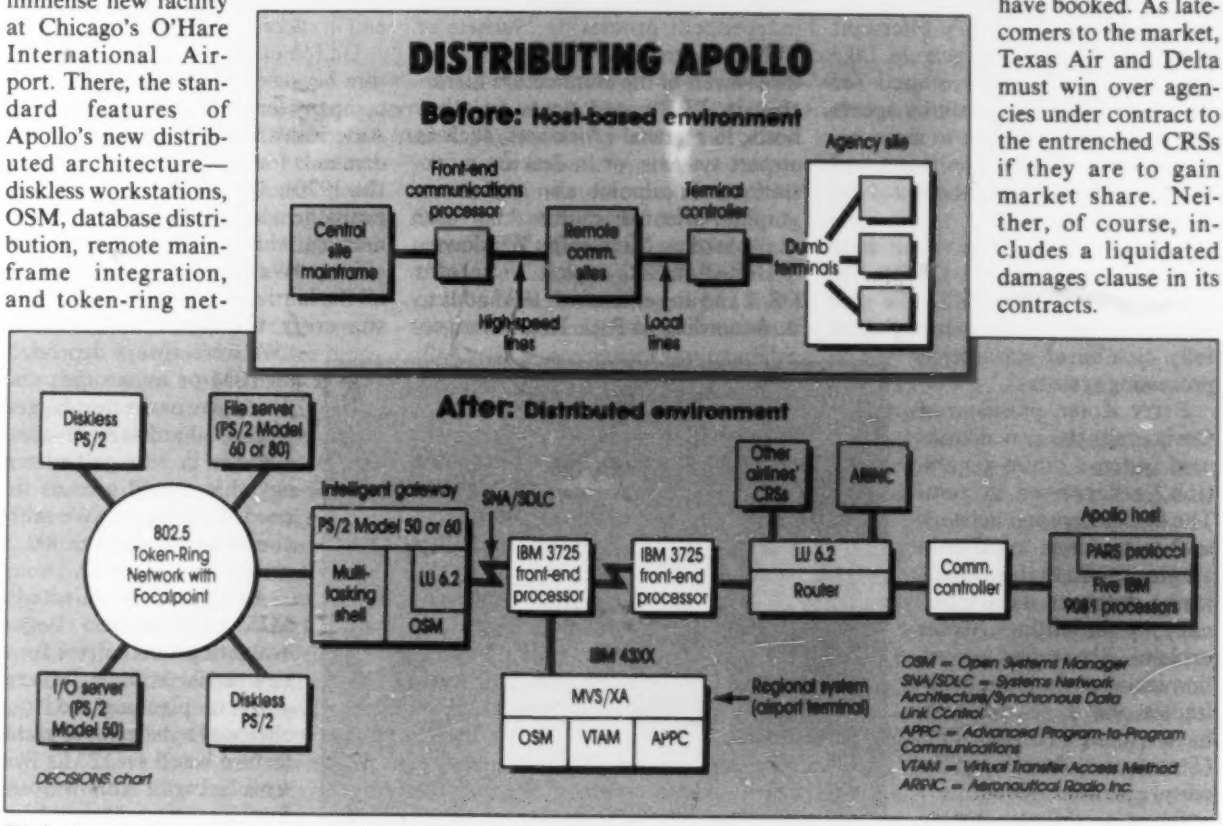
Writing software to integrate these elements led to the creation of a proprietary distributed transaction processing solution—primarily the OSM communications software—that United's Mark Teflian believes "has had and will have an impact on IBM's further development of Systems Application Architecture. We've basically developed a way to tie together different IBM operating systems through LU 6.2," he says.

To date, the biggest implementation of the new architecture is United's "Terminal for Tomorrow," its immense new facility at Chicago's O'Hare International Airport. There, the standard features of Apollo's new distributed architecture—diskless workstations, OSM, database distribution, remote mainframe integration, and token-ring network management—comprise the world's largest token-ring LAN, encompassing four token-ring backbones and 23 smaller token-ring nets able to handle a half million remote and local transactions daily. The network includes 130 workstations plus 150 other devices acting as gateways, file servers, and input/output servers. The network is managed through an adaptation of IBM's Netview.

United's distributed architecture may eventually give it an edge on SABRE in the reservation wars. But for now, American Airlines' system dominates the reservations market. SABRE's network includes nearly a million miles of data circuits and holds the schedules of 650 airlines—some 30 million fares—and information on 16,000 hotels and 33 car rental agencies, among many other elements. With 550 gigabytes of online storage, SABRE is the largest nonmilitary database in the world and is likely the world's largest private network.

Nevertheless, in the reservation wars, spending hundreds of millions on state-of-the-art systems is not enough. The big CRS providers guard their hard-won territories jealously, spending nearly equivalent amounts backing their networks with elaborate lawsuits against one another.

These lawsuits result from the tough tactics used by the entrenched CRS providers—American, United, and TWA—to keep agents on their networks. Generally, when an agency seeks release from a contract with one airline to convert to a rival's CRS, it must pay the airline for the cost of removing the equipment and for the lost equipment rental fees. In addition, these contracts, which typically run for five years, contain "liquidation damages" clauses that make agencies responsible for the estimated value of the offline booking fees from rival carriers whose passengers they would have booked. As latecomers to the market, Texas Air and Delta must win over agencies under contract to the entrenched CRSs if they are to gain market share. Neither, of course, includes a liquidated damages clause in its contracts.



With the recent upgrade of its Apollo computerized reservation system, United became the first airline to offer a distributed CRS. A key component of the system is the Focalpoint software family.

The cost of terminating a CRS contract in a large agency can run into millions, says Donald Sohn, president of Heritage Travel Inc., a Cambridge, MA, travel agency. A major reason agencies undergo the trauma of changing CRSs before a contract ends is market geography. Agencies may want to change if a new airline becomes the major carrier in its area.

Texas Air adds the incentive of defending agencies that switch to System One in lawsuits brought by the carrier whose contract is being broken. Last year Texas Air increased its travel agency market share to 18 percent, up 3 percent from 1986.

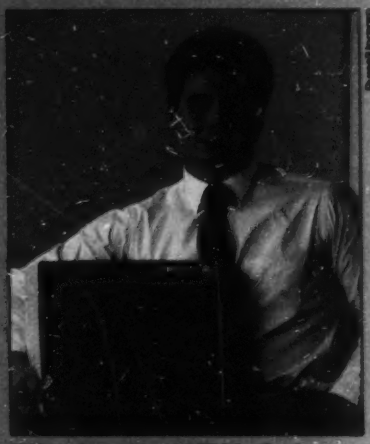
An innovation called Direct Access is probably System One's strongest selling point for agencies using rival CRSs, according to Nadine Godwin. First introduced by Eastern Airlines in 1981, Direct Access allows users to bypass ARINC (Aeronautical Radio Inc.), a corporation set up by the airline industry in the 1970s for switching messages and inquiries to and from each airline's database. With Direct Access, agents can make and confirm reservations directly from the inventories of other carriers. Although the feature has been replicated by the other carriers, System One offers the most complete system, with direct access to the databases of 23 carriers.

System One recently upstaged SABRE when its software was chosen by Amadeus, a consortium of four European airlines (Air France, Lufthansa, SAS, and Iberia), as the core of its proposed European CRS. One reason cited for the choice was Direct Access. U.S. CRS providers are keeping a close watch on European opportunities, another potential battleground. Covia won a contract to transfer major features of Apollo to a second European consortium, Galileo, which includes British Airways, KLM, and Swiss Air.

But the ultimate battle in the reservation wars is being waged between American Airlines and United Airlines. Says Covia's Mark Teflian, "With transactions and services growing—and they must proliferate to compete today—there is going to be a critical mass someday for all of us in terms of level and the number of applications that we are all planning on our networks. The platform provided by our distributed architecture will get us through that, resulting in a clear leadership position." D

INNOVATION ARCHITECT

Covia Corp., a United Airlines subsidiary, scored a competitive coup in the air wars last year when it introduced a distributed upgrade of its Apollo computerized reservation system, making Apollo the first distributed CRS. Mark Teflian, vice president of technical planning and engineering, led the development of this systems breakthrough.



Russell Ingram

When it comes to IBM, Covia Corp. is a leader, not a follower, says Mark Teflian.

In Teflian's view, the importance of the new system centers on its Open Systems Manager communications software. "OSM is a common set of communications, user interface, data, and application services that are homogeneous to all the different computing systems on our network," Teflian says. "Offering truly distributed applications means that services and functions for those applications have to be available at any point in the network."

OSM gives Covia a high degree of flexibility in managing Apollo, Teflian says. "OSM enables us to locate an application in one node on the network one day or move it to another one at another time when that's necessary," he observes.

A single consistent user interface to data and services is key, Teflian says. As an example, he cites Travelscreen Plus, a part of Apollo's new Focalpoint product family. "Part of Travelscreen's functionality is located in the local file server, and part in the central site," he says. "A travel agent with multiple branch offices can store an important customer's corporate profile on a central mainframe. Otherwise, the agency would need multiple copies of the disks for that same customer at each of its branch locations."

Teflian points out parallels between Covia's development of its distributed architecture and IBM's development of Systems Applications Architecture. "In 1983, when we decided to distribute Apollo's services, we assessed what functionality would be needed in our operating systems at the various network levels to provide application-independent processing, access to the data, and a common user interface," he says. "We used the architectural models available to us at that time—primarily higher-level SNA services like DIA/DCA [Document Interchange Architecture/Document Content Architecture], SNADS [SNA Distribution Services], and LU 6.2. For those services not available in our operating systems, whether they were in TPF, MVS, DOS, or Unix, we developed a common architectural model and set of services that we put into the distributed complex. This gave us the same level of services that IBM is now defining as SAA—the ability to allow cross-systems transparency in a distributed network."

Teflian adds, however, that IBM did not participate in or influence the development of OSM. If anything, he sees it the other way around. "Our development of OSM has had and will have an impact on IBM's further development of SAA," he says.

Covia will continue to track SAA's progress closely, Teflian concludes. "As our systems grow, we plan to adopt more of the embedded functionality that IBM and other vendors will provide. At the same time, we're not going to wait around. We're going to proceed with our products and structure them to take advantage of those advanced architectures when they come about."

MICRO INDUSTRY: SAFETY IN NUMBERS

Contrary to the predictions of some pundits, the micro business is still booming. The numbers tell the tale.

by Patrick Flanagan

The microcomputer market continues to grow at a blazing rate, to the surprise of some and to the profit of many—the many being the micro industry's leaders.

IBM's introduction last April of its Personal System/2 line did much to keep the fire in the micro market raging. By the end of last September, IBM had shipped more than a million PS/2s. Microsoft Corp. began delivering Operating System/2, the long-awaited next-generation micro operating system, in December. The arrival of PS/2 and OS/2 didn't mean a hasty exit for MS-DOS machines, however; sales of those micros held steady. Meanwhile, laser printers got cheaper and better, triggering hardware and software upgrades.

The 1988 DECISIONS Performance Report on the micro industry focuses on those companies for which micro-related products constitute the largest revenue-producing segment of their dp business, and is based on financial results for the 12 months ending September 30, 1987. The report does not reflect the impact of the October stock market plunge, but early financial data from some major vendors in the micro arena suggest that the crash had minimal impact on the industry. Apple Computer Inc., for example, continued its upward surge, posting fourth-quarter earnings of $121.4 million, more than double its earnings for the comparable period in 1986. Compaq Computer Corp. broke the $1 billion mark in annual sales and tripled its fourth-quarter earnings of a year earlier, posting $49 million in net profit for the quarter.

For the period October 1986 to September 1987, the 12 leading vendors in each of the three micro categories—systems, software, and peripherals—averaged revenue growth of 47.3 percent, 54.4 percent, and 21.2 percent, respectively. Average revenue growth of these 36 vendors was an impressive 41.9 percent, as their combined revenues exceeded the hefty $11 billion mark. And that revenue total doesn't include micro-related sales from large-systems vendors, including IBM, or original equipment manufacturer sales.

IMS America Ltd., a Plymouth Meeting, PA-based research firm, reports that

Computers

Courtesy of Tandon

Tandon CEO S.L. Tandon

Tandon saw 1987 sales soar 119 percent.

'87	'86	Computer company	'87 Revenues ($000)	'86 Revenues ($000)	Percent Growth	Total '87 Revenues ($000)	Total '87 Profits ($000)
1	1	Apple Computer Inc. *(Cupertino, CA)*	2,661,068	1,901,898	40	2,661,068	217,496
2	2	Tandy Corp. *(Fort Worth, TX)*	1,667,491	1,557,587	7	3,547,854	262,864
3	4	Zenith Electronics Corp. *(Glenview, IL)*	1,000,000*(E)	548,000*	82	2,300,000	N/A
4	3	Compaq Computer Corp. *(Houston)*	978,825	594,621	65	978,825	103,500
5	—	Leading Edge Products Inc. *(Canton, MA)*	400,000	N/A	N/A	400,000	N/A
6	5	NEC Information Systems Inc. *(Boxborough, MA)*	340,000	218,000	56	340,000	N/A
7	6	Tandon Corp. *(Chatsworth, CA)*	201,180	92,054	119	335,300	12,674
8	9	Dell Computer Corp. (PC's Ltd.) *(Austin, TX)*	150,000(E)	69,450	116	150,000	N/A
9	7	Telxon Corp. *(Akron, OH)*	108,360	91,947	18	108,360	13,232
10	8	Kaypro Corp. *(Solana Beach, CA)*	105,606	77,925	36	105,606	(9,597)
11	10	Grid Systems Inc. *(Fremont, CA)*	60,000	56,600	6	60,000	N/A
12	14	Iverson Technology Corp. *(McLean, VA)*	33,101	21,459	54	33,101	3,478
		Total	7,705,631	5,229,541	47.3		

**Calendar year*
(E)=Estimated
Unless otherwise noted, annual revenues are based on the four fiscal quarters ending on or near September 30, 1987.

'87	'86	Software company	'87 Revenues ($000)	'86 Revenues ($000)	Percent Growth	Total '87 Revenues ($000)	Total '87 Profits ($000)
1	2	Microsoft Corp. *(Redmond, WA)*	381,746	229,141	67	381,746	77,313
2	1	Lotus Development Corp. *(Cambridge, MA)*	361,799	272,872	33	361,799	64,699
3	3	Ashton-Tate *(Torrance, CA)*	244,425	160,259	53	244,425	37,739
4	4	Wordperfect Corp. *(Orem, UT)*	100,300*	52,239*	92	100,300	N/A
5	6	Autodesk Inc. *(Sausalito, CA)*	65,253	40,903	60	65,253	15,176
6	9	Borland International *(Scotts Valley, CA)*	50,000*(E)	29,200*	71	50,000	N/A
7	5	Softech Inc. *(Waltham, MA)*	42,664	46,319	-8	42,664	769
8	7	Micropro International Corp. *(San Rafael, CA)*	41,332	38,230	8	41,332	2,906
9	10	Software Publishing Corp. *(Mountain View, CA)*	38,576	23,662	63	38,576	5,193
10	11	The Santa Cruz Operation Inc. *(Santa Cruz, CA)*	36,600*	17,100*	114	36,600	N/A
11	—	Aldus Corp. *(Seattle)*	30,910	N/A	N/A	30,910	2,177
12	16	Adobe Systems Inc. *(Palo Alto, CA)*	30,688	12,774	140	30,688	6,861
		Total	1,424,293	922,699	54.4		

*Calendar year
(E)=Estimated
Unless otherwise noted, annual revenues are based on the four fiscal quarters ending on or near September 30, 1987.

Software

Cindy Charles

John E. Warnock of Adobe

No one has succeeded in cloning Postscript yet.

total sales of micros through computer dealers for the 12 months ending last November 30 reached $2.4 billion for 1.6 million units, up from $1.4 billion for 1.2 million units a year earlier. Although IMS reports on sales by computer dealers only, its data are significant because IMS actually audits dealer invoices, rather than rely on estimates from financial analysts.

The gain reported by IMS is particularly impressive considering that the average price paid for a micro rose to $1,500 from $1,167 the year before. The research firm concludes that the higher per-unit prices for micros are an indication that sales of low-end clones are slipping. Lap-tops contributed greatly to the market's growth, going from $23.6 million to $114 million in one year's time. IMS also reports no appreciable slowing of sales in November, the month after the stock market slide.

The microcomputer printer market—particularly the laser printer segment—also boomed, according to IMS data. Dealer sales of all types of printers were up by 34 percent, to $865 million. Dealer sales of laser printers went from 75,800 units to 144,300 units; that total represents a market share of 34 percent, up from 31 percent in the previous period. To the surprise of few, the gain in market share by laser printers came at the expense of daisy-wheel printers, which dropped from 6 percent to 3 percent of the market.

PS/2 stokes the fires

Most industry analysts agree that IBM's PS/2 was the most significant factor in keeping the micro business going strong. Apple pitched in too, scoring well with the Apple IIG and Macintosh SE machines. Compaq, Tandon Corp., and Zenith Electronics Corp. also showed strong results from sales of micros based on Intel 80286 and 80386 processors.

In recent years, the underlying strength of the micro market has been sales of IBM Personal Computer XT and PC AT clones. Will these commodity machines fade as IBM imposes a new standard based on the PS/2's Micro Channel bus architecture? "IBM is shattering the homogeneity of the micro business," observes John C. McCarthy of Forrester Research Inc., a Cambridge, MA, consultancy. He expects to see three tiers of microcomputer suppliers in the near future: those offering PC XT and PC AT clones in the $500 to $1,000 range; low-end Micro Channel suppliers serving mainstream users in medium to large companies; and vendors of high-performance Micro Channel systems for advanced applications, such as computer-aided design and manufacturing and number crunching based on mainframe database access.

There are still those who claim that the PS/2 and Micro Channel are overrated, but that's a message falling on deaf ears in the corporate computing world. The fourth DECISIONS/Paine Webber Survey of MIS Attitudes, results of which were processed in early December, shows that 41 percent of respondents believe OS/2 is important to information systems planning this year, 32 percent feel the same about multiuser micros, and 13 percent favor Micro Channel (see accompanying chart, page 48). In a Forrester Research survey of large corporations conducted in January, 85 percent of the respondents said they plan to standardize on PS/2s running under OS/2 this year.

One thing is certain: The Micro Channel market will not be conceded to IBM. What's holding the clone makers back at present is IBM's patents on key Micro Channel features, combined with a great

'87	'86	Peripherals company	'87 Revenues ($000)	'86 Revenues ($000)	Percent Growth	Total '87 Revenues ($000)	Total '87 Profits ($000)
1	1	Epson America Inc. *(Torrance, CA)*	520,000*(E)	500,000*(E)	4	N/A	N/A
2	2	Brother International Corp. *(Piscataway, NJ)*	412,000*	397,000*	4	1,030,000	N/A
3	3	AST Research Inc. *(Irvine, CA)*	244,327	168,842	45	244,327	9,958
4	4	Intelligent Systems, Master L.P. *(Norcross, GA)*	160,106	130,229	23	160,106	12,104
5	11	Everex Systems Inc. *(Fremont, CA)*	157,475	63,327	149	157,475	8,625
6	7	Quantum Corp. *(Milpitas, CA)*	155,504	113,082	38	155,504	4,157
7	9	Genicom Corp. *(Waynesboro, VA)*	151,959	86,236	76	257,557	9,692
8	6	Printronix Inc. *(Irvine, CA)*	120,026	127,692	-6	120,026	(6,407)
9	10	QMS Inc. *(Mobile, AL)*	119,399	73,633	62	119,399	8,671
10	13	CMS Enhancements Inc. *(Costa Mesa, CA)*	118,717	50,538	135	118,717	2,010
11	8	Emulex Corp. *(Costa Mesa, CA)*	107,583	105,544	2	107,583	3,525
12	5	Iomega Corp. *(Roy, UT)*	90,936	128,774	-29	90,936	(38,682)
		Total	2,366,032	1,944,897	21.2		

*Calendar year
(E)=Estimated
Unless otherwise noted, annual revenues are based on the four fiscal quarters ending on or near September 30, 1987.

deal of saber rattling from Big Blue. The major barriers to bringing PS/2 clones to market may have already fallen, however. Chips and Technologies Inc. (San Jose, CA) announced in January that it had developed a set of chips that emulate Micro Channel's functions. With the chip set, PS/2 clones could be in the market by midyear. Gerome Campbell, president of Chips and Technologies, is discussing a licensing agreement with IBM, but says, "We have no clear resolution." Two other companies, Adaptec Inc. (Milpitas, CA) and Phoenix Technologies (Norwood, MA), have developed the necessary disk controller and basic input/output system for PS/2 clones.

A number of analysts contend that some clone makers won't wait for a resolution of the tedious licensing negotiations with IBM. Observers disagree on whether IBM will take legal action against competitors that bring PS/2 clones to market. "Clone bashing in the Far East is acceptable, but IBM might not be eager for antitrust reasons to attack American manufacturers," ventures John McCarthy of Forrester. "For now, it's relying on a strategy of fear, uncertainty, and doubt through what it says to the press. When the first Micro Channel clone appears, it will legitimize the new IBM PS/2 technology by providing alternative sources. This is important to IBM."

Tim Bajarin of Creative Strategies, a Santa Clara, CA, consultancy, doesn't think clone makers will go unchallenged by IBM. "The first PS/2 clone vendor in the market will probably get hit with a suit to slow down the others as IBM builds PS/2 market share," he speculates. Bajarin agrees, however, that Micro Channel cloning is inevitable and that it will build acceptance of PS/2 machines.

Just who will be first in bringing out a PS/2 clone is unclear. Compaq, Zenith, PC's Limited (Dell Computer Corp.), and Wyse Technology (San Jose, CA) are prime candidates because each has the engineering staff to pull it off. The Japanese and South Korean manufacturers aren't talking. Neither are most of the other clone makers.

One vendor that will take its time in readying a PS/2 clone is Tandon Corp. Although Tandon's impressive 1987 results came in large part from European sales, in the U.S., demand for 80386 machines continued to exceed supply. "If the PS/2 becomes the standard, we will move into the market," says Ranjit Sitlani, executive vice president. He says that for the rest of the year or even longer, the Tandon 286- and 386-based machines can compete with the PS/2. Sitlani says questions about OS/2 are contributing to Tandon's wait-and-see attitude. "We want to see how fast OS/2 products are developed and how well they work," he says.

The quiet revolution

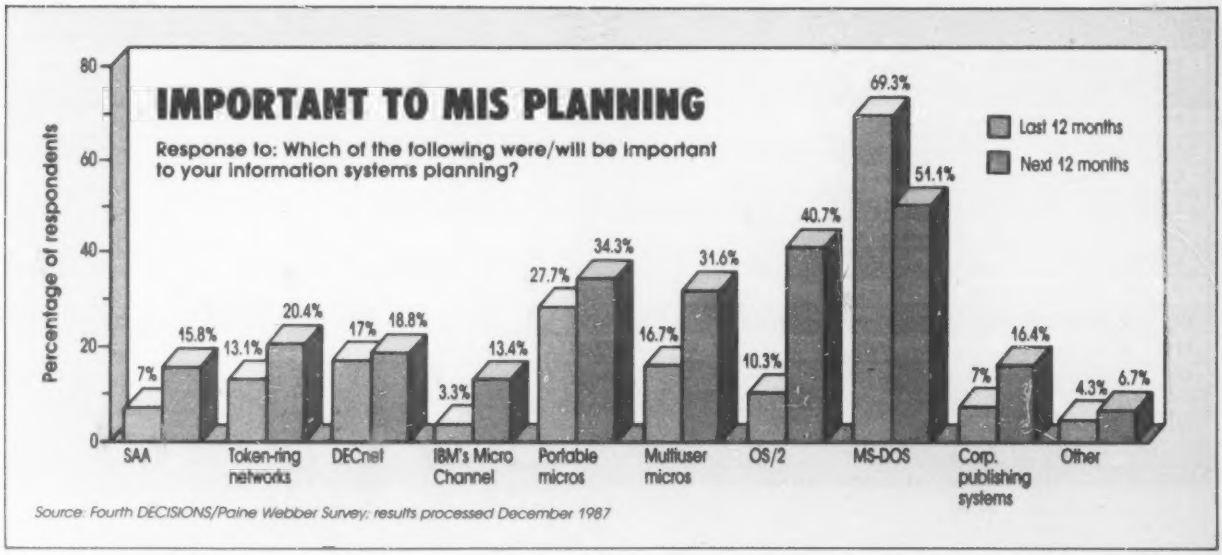
The thunderous arrival of the PS/2 has distracted attention away from a quiet revolution taking place in the peripherals segment of the micro market. Sales of high-end laser printers to corporations are growing at a rapid rate, spurred on by desktop publishing software and local-area networks that permit easier sharing of fast, high-quality printers. "We see laser printer use growing at 30 percent to 40 percent a year, and we're a long way from market saturation," says James L. Busby, CEO of QMS Inc., a supplier of laser and impact printers that had a huge jump in revenues last year. Busby says QMS's strategy is to plug products into all pricing levels, and to participate in numerous dis-

Peripherals

Alan Whitman

James L. Busby of QMS Inc.

'Laser printer use will grow at 30 to 40 percent a year.'



Vincent J. Gallo

tribution and sales channels and the OEM market as well.

Others that are well-positioned to cash in on the rapid growth in laser printer sales to corporations are IBM, Apple, and Hewlett-Packard Co., because of strong sales tie-ins with their microsystems and their ability to sell high-quality products with high profit margins. Those likely to suffer are suppliers with lower-priced printers, because profit margins will be eaten into by discounting and by growing competition.

A key to the popularity of laser printers has been Postscript, the page description language from Adobe Systems Inc. Postscript has propelled Adobe Systems onto the micro software fast track. From sales of $2 million in 1984, Adobe's annual revenues shot up to $39 million by the end of 1987. Postscript is licensed by virtually all laser printer vendors, the major exception being Hewlett-Packard, which uses a proprietary standard for its Laserjet's device-independent interface. Among the heavy hitters that have rallied around the Postscript standard are IBM, Apple, QMS, Texas Instruments Inc., Digital Equipment Corp., and NEC Information Systems Inc.

"This is a royalty business, and the increasing popularity of laser printers is due in part to the fact that Postscript has become so universal," says John E. Warnock, president of Adobe Systems. Warnock says the biggest threat Adobe faces is cloning. "We've had 14 competitors announce that they would clone [Postscript], but none has succeeded yet," he reports. Warnock says Postscript is difficult to clone because of strong proprietary technology, favorable licensing agreements, and aggressive upgrades on the part of Adobe.

A development to watch in software is the forthcoming Release 3.0 of Lotus Development Corp.'s 1-2-3. The package is being rewritten in the C language to take full advantage of OS/2 on Micro Channel PS/2s. According to John McCarthy, the new version of 1-2-3 should help boost sales of Micro Channel machines further because, he says, "PC AT-based micros don't have the memory and performance to take advantage of the upgrade." The new 1-2-3 will also create a fair amount of havoc among the vendors offering Lotus add-ons. "They are going to have to rewrite or tweak their products to link up [with Release 3.0], and that's going to create a lag," McCarthy asserts.

If Lotus is successful in its development and marketing efforts of the new release of 1-2-3, it may well regain the top ranking among independent micro software companies. This year's DECISIONS survey shows Lotus slipping to second place despite a 33 percent increase in revenues. Microsoft Corp. surged ahead of Lotus on the strength of a 67 percent gain in revenues.

Robert Therrien, software analyst at Wall Street brokerage Paine Webber Inc., doesn't expect the coming of PS/2 to have a dramatic impact on the software segment just yet. "DOS still has a lot of life, and Micro Channel isn't essential to run OS/2," he says. "The major application vendors will continue to do well, even though they face a lot more competition."

Among sellers of word processing software, Wordperfect Corp. continues to outrun its competition. Wordperfect's sales for 1987 surpassed $100 million, and the company expects revenues to exceed $170 million in 1988. Wordperfect's success seems to stem from the fact that it offers a full-function package that runs on numerous hardware platforms (including the DEC VAX), responsive customer service, and a constant stream of new releases. Version 5.0 of Wordperfect, which will include some major enhancements, is scheduled for availability late this month. Wordperfect is on the verge of becoming a corporate standard in the fragmented word processing arena. Its sales far outstrip those of the leading word processing package in earlier times, Wordstar from Micropro International Corp.

Therrien sees fertile markets in the areas of communications and database software. "These are the products that tie micros together and get maximum results," he says. Therrien doesn't expect one vendor to provide the solution in both areas. Instead, he speculates that a database engine could emerge that is a good match with an improved communications program. "If this happens," Therrien reasons, "a major advance will be made in terms of moving microcomputer use from a numerical orientation to a character orientation." D

Patrick Flanagan is a freelance writer based in New York. Laura Daly, a freelance editor based in Maywood, NJ, contributed to this report.